

which modern writers apply the old designation of Nahua (Nahuatl). But his description of the Aztec civilisation at the time of the Spanish Conquest scarcely suggests a state of decay. The handicrafts of the stone-cutter, the weaver, and the goldsmith, the elaborate organisation of the priesthood and the army, of the colleges for training boys and girls, and of the guilds of merchants, were found by the Europeans in full vigour. The Mexicans not only had a system of picture-writing and kept their chronicles in it, but King Nezahualcoyotl is said to have made a law prescribing the penalty of death on historians who should record fictitious events. This same king made severe forest-laws to prevent the supply of wood in the country being exhausted, so that the people did not dare even to pick up the fallen wood. Such a state of things may indicate a certain stiffness and artificiality of law and custom, but hardly a fall from an earlier higher state. In any new discussion of the problem of American civilisation, for which these volumes afford the first ample collection of materials, we should prefer reasoning on Aztec life as Cortes saw it, to speculating on the institutions of the half mythical Toltecs of tradition.

In looking through the present volumes two observations suggest themselves. Mr. Bancroft has drawn up descriptions of the languages of the Pacific district which are of some use in defining the general structure of each, and justifying the class-arrangement which he adopts. But he only gives a few specimen words of each language, such as pronouns, numerals, incomplete parts of a verb, and perhaps a Lord's Prayer. We wish, considering the space he has spared for native myths, that he had found room for a series of concise grammars. The existing grammars and dictionaries of many of these languages, even such as Aztec and Maya, which are the spoken languages of large populations, are so scarce and costly as to be out of the reach of ordinary philologists. For instance, it is difficult to get sufficient information as to one of the most curious languages of Mexico, the Otomi, described by several writers as a real monosyllabic language imbedded among languages like the Aztec, whose formation is polysyllabic-agglutinative in the extreme. This is a most interesting phenomenon in philology, and we looked to Mr. Bancroft at least to settle the disputed point whether the Otomi tongue is really monosyllabic. There are plenty of polysyllables in it, such as *tayo*, dog; *naxyo*, bitch; *mahetsi*, heaven; *nuga*, I. But the question is whether the statement is fully borne out, that "in words compounded of more than one syllable, each syllable preserves its original meaning." In the first two instances this is evidently true, *ta-yo*, *naxu-yo* being decomposable as "male dog," "female dog." Whether the other two words can be analysed we do not know. So interesting is the Otomi tongue for its bearing on the theory of the monosyllabic origin of language, that it would be worth while to collect and reprint everything that is known about it. For one thing thanks are due to Mr. Bancroft, that he insists on the merely accidental character of such resemblances as exist between Otomi and Chinese. Naxera's baseless theory of a connection between these two languages had publicity given to it by Prescott, and is not yet forgotten.

The collection of cosmogonic traditions in the third volume is remarkable, and may lead us to expect valuable

results to science when the creation-myths of all tribes and nations of the world shall be put together and carefully analysed. Many of them are of course mere products of childish fancy. In Central California the story is that in the beginning the world was dark, so that men and beasts and birds were always stumbling and dashing against one another. The Hawk happening to fly in the face of the Coyote (Prairie-wolf), they mutually apologised, and set to improve things. The Coyote made balls of reeds and gave them with some pieces of flint to the Hawk, who flew up into the sky with them and set them alight. The sun-ball still glows red and fierce, but the moon-ball was damp, and has always burnt in a feeble, uncertain way. The Southern Californians, on the other hand, believe that the sun and moon were the first man and woman; women, descendants of the moon, are fair but fickle, for as she changes so they all change, say these savage philosophers. Such mythical fancies, of which there are numbers in this one district, fall within the province of the pure mythologist. But it is an interesting question whether, among the legends of catastrophes which altered the face of the earth and destroyed its inhabitants, there may be any dim recollections of actual events, recognisable by the antiquary or the naturalist. To take another example from California, the natives about Lake Tahoe ascribe its origin to a great natural convulsion. Their story is that their ancestors were once numerous and rich, but a stronger people rose up who defeated and enslaved them. Then the Great Spirit sent an immense wave across the continent from the sea, which engulfed both oppressors and oppressed, all but a small remnant. Those who remained of the ruling caste made the people build a great temple for refuge in case of another flood, and on the top of this the masters worshipped a perpetual fire. Soon, however, the earth was troubled again, this time with strong convulsions and thunders. The masters took refuge in their great tower, shutting out the slaves, who fled to the Humboldt River, and paddled for their lives, for the land was tossing like a troubled sea, casting up fire, smoke, and ashes. The Sierra was mounded up from the bosom of the earth, while the place where the great fort stood sank, leaving only the dome at the top exposed above the waters of Lake Tahoe.

Such is the local story, remarkable for its good descriptions of an earthquake-wave, an eruption, and a volcanic upheaval and subsidence. Whether it is founded on some fragmentary reminiscences of a real local catastrophe is a question which we leave to be answered by some geologist who has examined the district.

HUXLEY AND MARTIN'S "ELEMENTARY BIOLOGY"

A Course of Practical Instruction in Elementary Biology. By T. H. Huxley, LL.D., Sec. R. S., assisted by H. N. Martin, B.A., D.Sc. (London: Macmillan and Co., 1875.)

IN the preface to this work, Prof. Huxley tells that the object of his book is to serve as a laboratory guide to those who are inclined to study the principles of Biology as a single science, and not as one divided, except for the sake of convenience, into the two "disciplines," Zoology and Botany. To accomplish this end a certain

number of readily obtainable plants and animals have been selected for minute description, in which the most important types of vegetable and animal organisation are capable of being demonstrated. With reference to each species selected, an account of its anatomy is given, which is followed by laboratory instructions as to the manipulatory detail necessary for its complete verification. The types selected include Yeast, Protococcus, the Proteus Animalcule, Bacteria, Moulds, Stoneworts, the Bracken Fern, the Bean Plant, the Bell Animalcule, the freshwater Polype and Mussel, the Crayfish and Lobster, and the Frog. As an illustration of the form in which the laboratory directions are given, the following quotation from a portion of the dissection of the Frog will serve as a fair example:—

“DISSECTION OF THE VISCERA IN THE VENTRAL CAVITY.

“1. Lay a frog, which has been killed with chloroform, on its back, and pin it out on a layer of paraffin or beeswax, under water; divide the skin along the abdominal median line from the pelvis to the front of the lower jaw; next make a transverse incision at each end of the longitudinal one, and then throw outwards the two flaps of skin thus marked out. The following points may now be noted:—

“a. A great vein (*musculo-cutaneous*) on the under surface of each flap of skin, about the level of the shoulder.

“b. Some of the muscles of the abdominal wall, covered by a thin aponeurosis; through this latter can be seen—

“c. The *rectus abdominis*, running from pelvis to sternum, close to the middle line, and divided into a number of bellies by transverse tendinous intersections.

“β. Other muscles outside the rectus on each side.

“c. The *pectoral region*: part of its hard parts in the middle line, only covered by tendinous tissue; external to this, muscles running towards the shoulder-joint.

“d. The *muscles of the throat*: small and with a general direction from the lower jaw towards the sternum and shoulder-girdle.

“2. Raise the tissues of the body-wall with a pair of forceps, and carefully divide them, a little to the right of the median line,” &c.

From what has been said above it is evident that there are two features in this volume of Prof. Huxley's which call for special notice on account of their novelty. The first of these is that Botany and Zoology are taught in combination, as parts of the science of living organisations—Biology. The second is that the subject is taught practically; in other words, with full information on how to observe the features described.

Most amateur students of so-called science, or collectors, run in a single groove of thought. They learn to recognise specific differences in those groups of animals, fossils, or plants which they honour with their patronage; they discover minute variations in individual specimens, and frequently attempt to load nomenclature with fresh names, which may or may not have to be swamped in the mass of synonyms—already but too large—according to their knowledge of the literature of the subject they affect. In the scale of scientific investigators these stand lowest. They do good; their work is indispensable; the mental effort required for its production is,

however, small, and is generally associated with a want of power to grasp general principles which is frequently quite surprising. The opportunity of seeing, or, better still, possessing “type” specimens is their highest gratification; and their opinion on any point involving more than generic differences is unreliable.

A second class of student advances further. Collection of familiar forms is not the object kept in view by them. They study the literature of their subject, having previously received a sound educational foundation. They do not make fresh and independent observations themselves, but delight in verifying those of others. New facts they absorb; and by engrafting them upon their previous ideas, modify the latter—generally prematurely—in a direction which they prophesy to be the science of the future. They draw extreme deductions on insufficient evidence, and are apt to fall whilst attempting to substantiate them. These are not to be trusted in the definition of a sub-kingdom.

A third class investigate on their own account. They study the works of others; and by thoroughly digesting the new and old facts at their disposal, are in a position to modify generally accepted views on important questions by the publication of arguments as cogent as they are reliable. These original investigators have their independent views on the most general principles.

Such being the case, we may employ the scale of biological relationships as a rough standard of the mental capacities of working students. It leads us to look upon everything which tends to inclusiveness as an advance in the right direction, and everything in the opposite direction as retrograde. All biologists must therefore thank Prof. Huxley for having introduced into the preliminary training of students of Natural History the conception of the complete unity of plant- and animal-life, and of the comparative insignificance of the gulf between the two.

Prof. Huxley teaches Biology *practically*. The pupil has to see with his own eyes all that he reads about; and what is more, he has to find what he is to see. Practical education is a praiseworthy characteristic of the present age. Numbers of laboratories, in this country and on the Continent, have been recently established for the teaching of Physics, Physiology, and lastly Biology. That this practical phase must be generally adopted in scientific education becomes more certain as the scientific training itself becomes more and more a part of the preliminary education. The tendency in recent times to estimate classics at a lower value as a discipline than formerly, is one which necessitates the introduction of a substitute; of a means by which a training in the method of work shall be the mental exercise, whilst mere facts shall not have the prominence generally given them in the scientific lecture-room. As a training, practical biology offers all the requirements, at the same time that it leaves those who have pursued it, after they have finished their education, in a position peculiarly favourable for the prosecution of original investigation on their own account. From this view of the subject we have also therefore to thank Prof. Huxley for having added Biology to the list of those sciences which are taught practically as well as theoretically.

It has also special advantages in this direction. No expensive outlay is necessary for the purchase of apparatus; a well-lighted room, together with a microscope,

scalpels, forceps, and scissors, being nearly all that is essential to a biological laboratory. These can be procured by anyone; and the student when thus equipped with Huxley and Martin's "Practical Biology" in his hands, need only look around for some of the most easily obtainable animals, upon getting which he can start work in good earnest.

In the descriptive portion of the work there is one point to which we cannot help referring, which is in connection with the circulation of the blood. It is an explanation, originally given by Brücke, we believe, of the manner in which the mixed arterial and venous blood in the single ventricle of the frog is distributed in such a manner that the venous blood mostly enters the lungs. "It fills (during the systole) the *conus arteriosus*, and, finding least resistance in the short and wide pulmonary vessels, passes along the left side of the median valve into them. But as they become distended and less resistance is offered elsewhere, the next portion passes on the right side of the longitudinal valve into the aortic arches." The words italicised by us are those which it is difficult to comprehend, for it is evident that if the pulmonary artery offers less resistance at the commencement of the systole, it will do so all through the revolution in proportion to the relative calibre of its capillaries and those of the system generally; and then there is no reason why the valve should flap back.

OUR BOOK SHELF

Rotomahana, and the Boiling Springs of New Zealand.

A Photographic Series of Sixteen Views, by D. L. Mundy. With descriptive notes by Ferdinand von Hochstetter, Professor of the Polytechnic Institution of Vienna. (London: Sampson Low and Co., 1875.)

THE autotype illustrations which form the main feature of this handsome volume are triumphs of the photographic art, and reflect the highest credit upon their author, Mr. Mundy. The photographs are on a scale quite large enough to give one a satisfactory idea of the main features of the various scenes intended to be portrayed; and by the judicious introduction into most of the views of the human figure, a good idea of the scale of the photographs is at once afforded.

The remarkable region illustrated by Mr. Mundy's series of photographs lies just about the centre of the North Island of New Zealand, in the south of the province of Auckland. The culminating or rather originating point of the phenomena described, Prof. Hochstetter regards as the still active volcano Tongariro, in the north of the province of Wellington. From this volcano three lines of volcanic action are supposed to proceed in a north-easterly direction by Lake Taupo to Lakes Rotorua, Rotoiti, and Rotomahana respectively, the last-mentioned line proceeding inwards as far as the marine volcano Whakari, in the Bay of Plenty; this line also, near its source, includes the hot springs at the head of Lake Taupo, about forty miles to the north of Tongariro. Another line, which follows to some length the outflow of the river Waikato from Lake Taupo, is marked by the hot springs and steam jets of Otumaheke and Orakeikorako, on the river's banks, and those of the Pairoa mountain range. The third line of action forming eruptions of this kind is exhibited in the hot springs of Rotorua and the solfataras of Rotoiti, which terminate these specimens of volcanic action on land, being situated near the sea-coast. While all along these three lines evidences of volcanic action are visible in the shape of hot springs, solfataras, geysers, mud-lakes, &c., the chief

interest centres in Rotomahana, where the most beautiful and marvellous effects of this action are displayed. Though on a much smaller scale, the phenomena greatly resemble those which are seen in such profusion in the Yellowstone region of North America.

Mr. Mundy devotes most of his photographic views to the illustration of the phenomena to be witnessed in and around Rotomahana. This is one of the smallest lakes in the region, being scarcely a mile in length and a quarter of a mile in breadth; it is 1,088 feet above the sea, and the temperature of the lake itself varies from 60° to 100° Fabr. On the margin of the lake are many boiling springs, and around it are a great variety of phenomena similar to those which are witnessed in Iceland and in North America. It is impossible in a few words to give any adequate idea of these phenomena, and we must therefore refer our readers to Mr. Mundy's beautiful illustrations, and Prof. Hochstetter's brief but clear descriptions. One of the photographs gives a fine view of Lake Rotorua, about twelve miles north of Rotomahana, and the last four are devoted to the illustration of Lake Taupo and the phenomena to be seen in its neighbourhood. Rotomahana, we may state, is about forty-five miles N.N.E. of Lake Taupo, and about double that distance from Mount Tongariro.

Lake Taupo lies at a height of 1,250 feet above the sea, and no bottom has been found at a depth of 200 fathoms. Prof. Hochstetter conjectures that its waters, which have only one visible outlet, the Waikato, but many tributary streams, has a subterranean outlet to the north. It is this, he believes, which gives rise to the curious phenomena which abound in the region to which Mr. Mundy's photographs refer; the water, after being heated by underground volcanic fires, generates high-pressure steam that forces its way to the surface, bearing the characteristics of the rocks with which it has come into contact: the New Zealand springs, we should say, are divided into two distinct classes, the one alkaline, and the other acid. Whatever may be the value of Prof. Hochstetter's explanation of the phenomena, there is no doubt about the value of Mr. Mundy's illustrations of a district which seems to be all that now remains of a once extensive active volcanic region. While as a collection of well-executed views of great interest the work deserves a wide circulation, to the student of geology it is of great value, as affording a far more satisfactory idea of an important feature of the physical geography of New Zealand than any mere description can convey.

Elementary Lessons in Botanical Geography. By J. G. Baker, F.L.S., Assistant Curator of the Herbarium at Kew. (London: L. Reeve and Co., 1875.)

A WANT has long been felt of a small text-book for the use of lecturers and students dealing with the distribution of plants on the face of the globe. A work of this kind necessarily contains a large amount of detail and a formidable array of plant-names. These features of the present little volume are less objectionable when its special purpose is borne in mind, viz., the instruction of gardeners; the various chapters into which it is divided being in fact the substance of a series of lectures delivered to the gardeners at Kew. A reference to these details would be out of place in a short notice; and the best idea will be conveyed by giving the author's final summing up, viz.:—That each species has originated from a single centre; that species have originated in different parts of the world, and that the flora of any given tract depends largely on its geographical position; that a large portion of the present genera (or types which agree in structure down to minute detail) were in existence before the end of the Secondary period, and have passed through the very great changes in climate and the relative positions of sea and land that have occurred during the Tertiary period; and that species (or types which accord not in structure only,